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The Story of
Leather, Boots and Shoes

BY
W. F. ROCHELEAU

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LEATHER



AS YOU probably know, all leather is made from the skins of animals by a process called tanning or tawing, which is but a modified form of tanning. Physiology tells us that the skin consists of two layers, the dermis, or true skin, and the epidermis, or surface skin. The dermis is made up of fibers compactly interlaced and woven together. These fibers contain a large proportion of the substance like that from which glue and gelatin are made when it is boiled. The skins of animals do not differ in this particular from that of the human system, and it is the der-

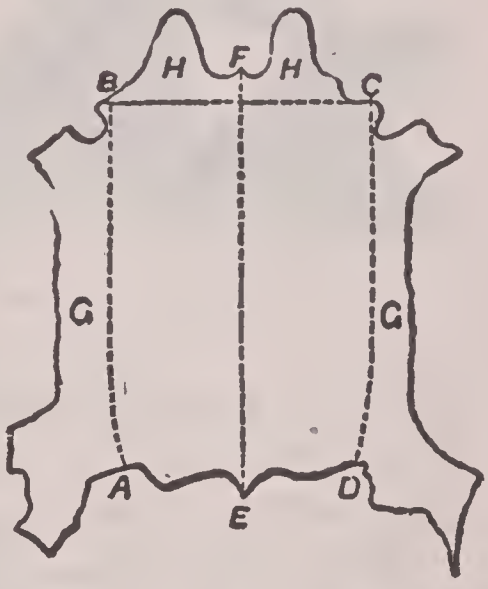
mis of these skins that is changed into leather by tanning. Many years ago it was discovered that the barks of certain trees, such as oak and hemlock, and the leaves of other plants, like the sumach, contain substances which would unite with the gelatin in the fiber of the skin, and, in the course of time, change it into a hard, tough substance. This, in the main, is the process of tanning.

When the hides reach the tannery, they are usually packed in salt to prevent decay. The first step is to clean and soften them. This requires several days' soaking in water, followed by a thorough washing. They are next placed in a strong solution of lime for a number of days to loosen the hair, so it can be easily removed. This is done by a process called beaming. The workman places the hide on a bench having a round upper surface, and two legs about three feet high at one end, while the other end rests upon the floor. He now takes a knife having a dull edge, and the blade shaped to fit the surface of the bench, and with this proceeds to scrape off the hair. The hides are again thoroughly washed, and then placed in a solution known as the "bate," which prepares them for the tanning process.

The bark is ground and steeped, and the hides are soaked in the liquor thus obtained. Sometimes the hides are packed in vats with layers of

bark between them, in addition to the solution. The length of time required to tan the skin depends upon its thickness and upon the quality and kind of leather desired. Continuous study of the process, and improvements in the material and machinery used, have succeeded in improving the quality of leather, as well as in shortening the time required for tanning, and also reducing the price of the product.

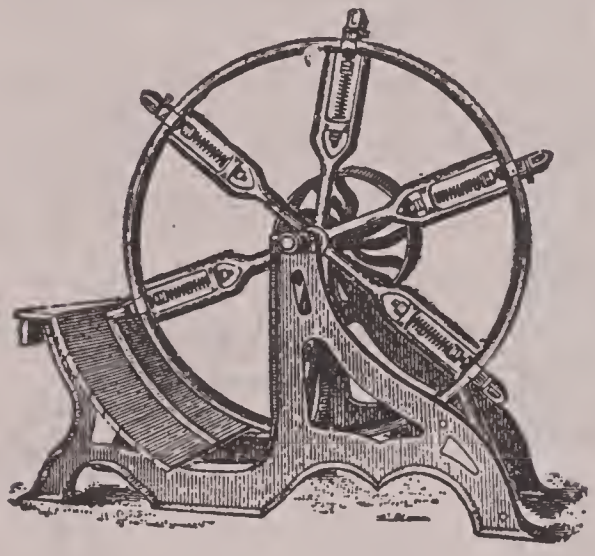
But little change has been made in the process of tanning, as the chemical action on the skins must be the same that it was at the beginning of the art. The changes have been in the methods of working, and these have been brought about by the invention of machines for doing many parts of the work which were formerly performed by hand labor. Several of these machines consist of sets of rolls and polishing wheels, and are used in finishing the leather. By their use what before required hours of hard work, can now be accomplished in a few minutes.



HOW A HIDE IS CUT

Sole leather is made from the backs and shoulders of the hides of cattle and buffalo, and requires a longer time to tan than the thinner

skins used for the uppers of shoes. These are usually made from the hides of calves, young cattle, and a small breed of cattle common in Russia, India, and Africa. All light and spongy leather, like morocco and its imitations, are made from the skins of sheep and goats. Alligator skins were first tanned in Louisiana about 1855, and since that time the manufacture of this sort of leather has developed into quite an industry. Russia and Cordovan are varieties which originated in Europe, but are now manufactured in this country. The so-called morocco is a modification and improvement of the Cordovan, and is extensively used in bookbinding and the covering of cases.



POLISHING MACHINE

There are three kinds of leather, based on the methods of manufacture. Tanned leather is made by combining the gelatin of the skin with the tannin of the barks of trees. Tawed leather is made by combining the gelatin with the salts of certain minerals. Shamoyed leather is made by combining the gelatin with oils and fatty substances. The tawed and shamoyed are used for

gloves, clothing, and various domestic purposes. Some of the finer qualities are finished in highly ornamental colors, but the red tanned leather is the oldest in this country and takes precedence over all other varieties.

The location of tanneries has been determined largely by the distribution of tanning materials. Naturally the centers of the leather trade have followed the tanneries. Hemlock bark is found quite generally in Pennsylvania, and the States along the Alleghany range to the north of it, in Canada, and in some sections around the Great Lakes. New York is the largest leather market in the United States, with Boston next in importance. Philadelphia, Baltimore, and Chicago are also important centers. New York, Pennsylvania, and Massachusetts are the leading States in the manufacture of leather, while Maine, Illinois, and Ohio have the industry well developed, and the annual output for the entire country exceeds $600,000,000.

BOOTS AND SHOES



SHOES are undoubtedly one of the oldest articles of dress. The first shoes were mere sandals for the protection of the foot. But even in so simple an article as this we find national taste displayed at an early date. The Egyptians used sandals of palm leaves and leather, while the Hebrews preferred linen or even wood. These were fastened to the foot by thongs, or cords passing over the ball of the foot and around the ankle. The men among the ancient Greeks went bare-footed, but the women early began to wear a covering for the foot, and from this beginning the custom became general. The Romans seem to have taken the custom from the Greeks, and when the shoe was once introduced into these nations, a multiplicity of styles soon followed.

Among the royal households and aristocracy

the shoe early became a distinguished article of dress. We read that in the days of Richard II., of England, the points at the toe had increased to such length that they reached the knee, to which they were attached by gold or silver chains. The upper parts were cut to imitate the windows of a church, and the whole shoe was very conspicuous. For nearly three hundred years did the clergy, the popes, and public officers strive to abolish this extravagant, and what would seem to be foolish, custom. Finally, by act of Parliament in about the middle of the fifteenth century, shoemakers were prohibited from making for the unprivileged classes any shoes with points more than two inches long. But it seems that the shoemakers of that day were equal to the emergency which often confronts their modern representatives. They must have something for style, and when they were prohibited from extending the toe lengthwise, they began to increase its width, and we find in the days of Queen Mary another decree restricting the width of the toe to six inches.

The shoe of the sixteenth century in Europe, and among the court classes, was an elaborate article of leather and cloth, often ornamented with gold, silver, and jewels. Among all civilized nations the shoe is a badge of distinction. But the most strange and unnatural shoe is that of the Chinese lady of rank. From infancy the

growth of her feet has been checked by bandages at the expense of extreme suffering and inconvenience, for the higher she is in rank the smaller her feet must be, and it is customary to find women in China who can wear shoes three and four inches long. These shoes are usually made of silk and richly ornamented; durability is of little consequence, for the poor woman has sacrificed her ability to walk, and must remain a cripple all her life.

Among the peasantry of Europe the wooden shoe, or French "sabot," has been in common use for centuries. It is durable, cheap, and said by the wearer to be comfortable. We occasionally find these shoes on the market in the United States in towns where the surrounding country is largely settled by immigrants. The older people in these communities still cling to the customs of their native land and prefer the wooden shoe to that of a more modern and comfortable make.

The early settlers of America did not desire stylish shoes. But they were in great need of a covering for the foot which would serve as a protection against the cold and the rough ground which they worked. Some attempted to use the moccasins of the Indians, but they were not durable for such work as clearing the land and breaking it up for tillage. The shoemaker was an early necessity in the colonies, and we

find him among the earliest craftsmen who came to the New World.

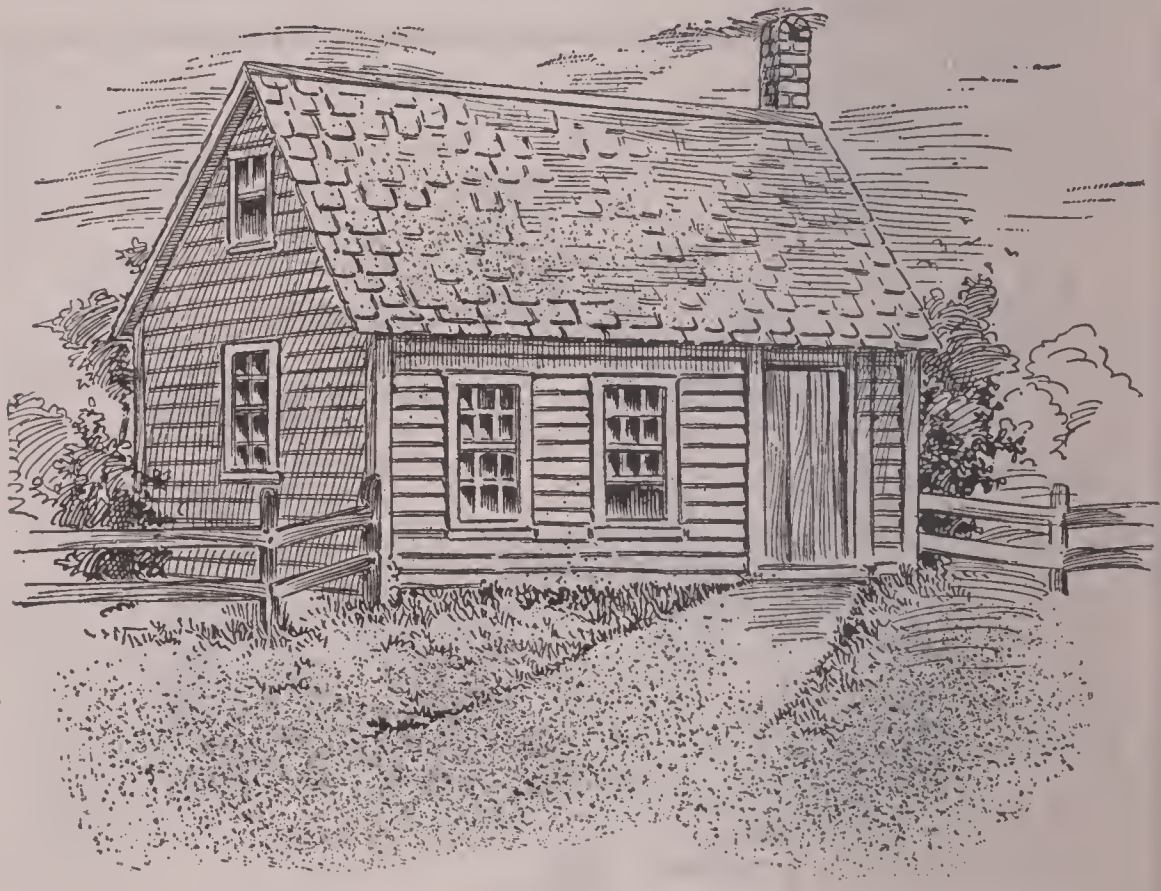
Among the records of Plymouth colony there is an old document bearing the date of 1629, stating that Thomas Beard with "hides" both upper and bottom was shipped out on the Mayflower, and the governor was recommended to give him "lodging and diet." Beard must have been heartily welcomed by the colonists, for we learn that he was presented with fifty acres of land in addition to his living, as recommended to the governor of the colony. The shoe-making industry of the United States had its origin in Lynn, Mass., which city has since become the largest shoe-manufacturing center in the country, if



MAKING SHOES BY HAND

not in the world, and is known as "The City of Shoes."

In the beginning, the shoemaker traveled from house to house with his kit of tools, working up the leather of the family. The tools were poor,



AN OLD LYNN SHOE SHOP

the leather was usually of an inferior quality, the workman was unskilled, and the product anything but what the well-dressed lady or gentleman of to-day would care to appear abroad in. Yet it gave necessary protection and a good degree of comfort to the wearer. The industry in and around Lynn soon grew to such propor-

tions as to call for the erection of shops, and the shoemaker stopped traveling. But this custom was continued for many years among the more sparsely settled portions of New England, and the writer distinctly remembers when it was in vogue among the Canadian farmers of the Province of Quebec, and almost under the shadow of Mount Royal.

The old-fashioned shoe shop was a small one-story building containing a room from 12 to 15 feet square, with windows at the ends and side, and a fireplace in one corner. The workmen had their benches placed around the sides of the room and here with their tools, which comprised a hammer, lap-stone, knives, and hones, master-workman, journeyman, and apprentice met on the same level, and shared alike.

The occupation was one which induced to steady habits, and gave plenty of opportunity for meditation. We find that the old-time shoemaker was, with scarcely an exception, a man of good habits, strong character, and an excellent citizen. It was of men like these that Whittier wrote:—

> The foremost still, by day or night,
> On moated mound or heather,
> Where'er the need of trampled right
> Brought toiling men together;
> Where the free burghers from the wall
> Defied the mail-clad master,

Than yours, at Freedom's trumpet-call,
No craftsman rallied faster.

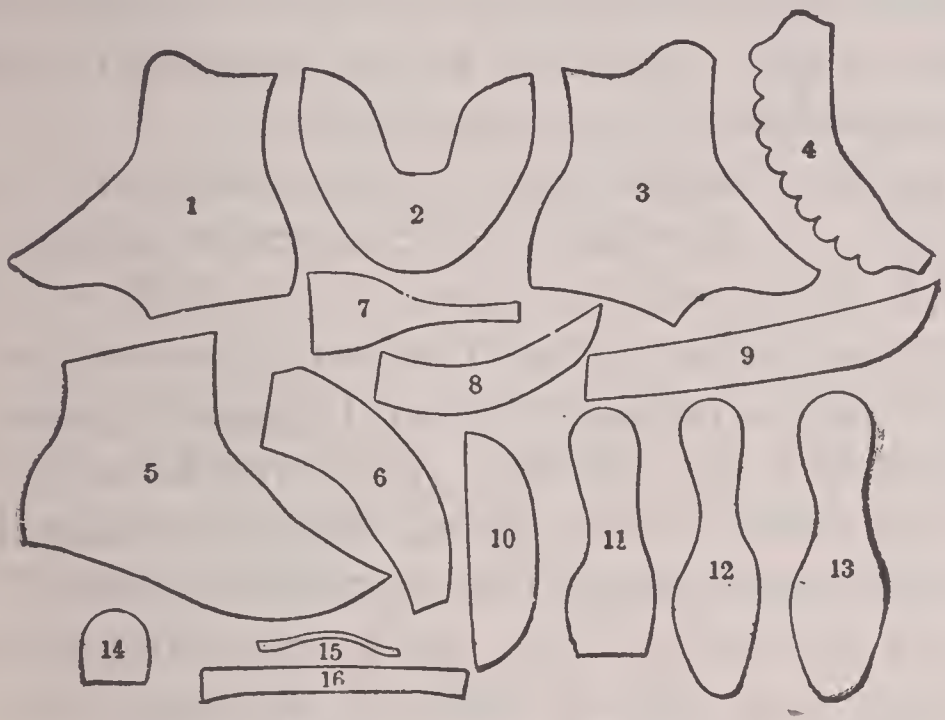
Let foplings sneer, let fools deride,—
Ye heed no idle scorner;
Free hands and hearts are still your pride,
And duty done, your honor.
Ye dare to trust for honest fame,
The jury time empanels,
And leave to truth each noble name
Which glorifies your annals.

* * * * * * * * *

The red brick to mason's hand,
The brown earth to the tillers,
The shoe in yours shall wealth command,
Like fairy Cinderella's!.
As they who shunned the household maid
Beheld the crown upon her,
So all shall see your toil repaid
With hearth and home and honor.

The essential parts of a shoe are the upper, the sole, and the heel stiffening. These may be further subdivided into the vamp for covering the front of the foot, the large and small quarters for encircling the ankle, and the button piece for the uppers; and the outer and inner sole and heel for the bottoms. The shoemaker must sew these pieces together in the desired form, fasten them to the sole which has been previously cut, attach the heel and give the whole the finish and style necessary to fit it for the market.

Whatever machines are used in making a shoe must do these various lines of work. Modern inventions have necessitated the subdivision of these operations to the minutest detail, and per-



PARTS OF A BUTTON SHOE

1, large quarter; 2, vamp; 3, small quarter; 4, button piece; 5, drill lining; 6, glove button-piece lining; 7, heel lining stay; 8, button stay; 9, top stay; 10, heel stiffener; 11, sole lining; 12, inner sole; 13, outer sole; 14, heel lifts (six); 15, steel shank, 16, rand.

fected machines for performing them all successfully, even much better than could be done by hand labor.

The modern shoe factory with its complex machinery and large number of operatives has been an institution of slow growth, and has developed as the demands upon the trade have called for larger facilities. From the unshapely

shoe of the traveling cobbler, came the well-made shoe of the old hand-shop—indeed, the shoemakers of Lynn and vicinity became so skillful before the Revolution that a Boston paper bearing the date of 1764 speaks of the women's shoes made in that town as being superior to those imported from the mother country.

The Revolution gave a great impetus to the industry, as the demand for boots for the Continental army was far beyond the ability of the shops to supply. After the war, however, heavy importations of shoes from England caused a decline, but the country recovered from this in the course of a few years, and the shoemakers became more prosperous than ever. Still all the work was done by hand, and without any division of labor. A pair of shoes a day per man was considered a good output, and in this way the work went on for many years. Finally, some enterprising manufacturers conceived the idea of grouping their workmen, consequently several shops were combined. Some of the workmen were given the cutting, others the sewing of the uppers, and others the fastening on of the sole. The advantages of this plan were at once so apparent that it soon became general. Much of the lighter work was let out to women to be done in the home, and "Hannah Binding Shoes" could be found in almost every household in Eastern Massachusetts.

This was really the beginning of the factory system. The rolling machine seems to be the first machine introduced, and this was in 1850. By means of this a workman could accomplish in a minute what would take him a half hour to do with his hammer and lap-stone: viz., to press the sole leather together so as to make it compact, and at the same time pliable for working. The splitting machine soon followed. By the use of this the leather was made of uniform thickness. Before the introduction of this machine all paring down had to be done by hand. This required a good deal of time, and did not secure as good results as could be obtained with machinery. These machines were operated by hand or foot power.

It was, however, left for the sewing machine to revolutionize the shoe industry. Within a few years from its first appearance, we find various modifications of it in the shoe factory, each made for its special kind of work. The next great invention was the McKay sewing machine for sewing the sole to the uppers. In the hands of a skillful operator this machine will sew the soles on to 800 pairs of woman's shoes in ten hours. Other machines for fastening the soles with wire, and also with nails, have been invented, and are now in constant use in all large factories. At first shoes made by these machines did not have as good a finish as those made by

hand; but the invention of the Goodyear welt machine, which grooves the sole for sewing, now enables the machine to rival the most skilled workman. Two other machines which have added much to the efficiency of the factory are the Bigelow heeling and attaching machines. The first presses the leather heel into a solid mass, and sets the nails ready for driving; the second with a single motion fixes the heel in place. Machines for cutting the soles, shaping and finishing the heel, blacking, and polishing are also found in great variety. Each does its special work. In fact, in the modern shoe factory, the work of the operators may be said to consist in passing the pieces from one machine to another until they come from the last a finished shoe. In no other industry is the division of labor more perfect, or is there a larger proportion performed by machinery.

THE MANUFACTURE

Let us now follow the leather through the factory, and see how it becomes a shoe in passing through the hands of a large number of operatives and being treated by these numerous machines. The factory is divided into three departments: that in which the work is done on the soles, that in which it is done on the uppers, and that in which the shoe is put together.

IN THE CUTTING ROOM

The first process is that of cutting, and we will begin with this in the department of the uppers. This is all hand labor. We find workmen standing before high tables, each with a pile of stock beside him. Each cutter has a full set of patterns, and a small knife with a narrow blade so bent at the point as to somewhat resemble a hook. This knife he keeps very sharp. The cutter must plan his work so as to get the largest number of pieces out of each skin, and also to cut the vamp from that portion which is the most durable, and to cut it with his pattern in such a position as to have the length run the right way of the leather, or it will not finish well. One might think that these problems would lead to hesitation over each new skin, but the practiced eye of the cutter enables him to see at a glance what he can do to the best advantage, and he rapidly lays pattern after pattern, and runs his knife around it until no pieces remain large enough to work up. So carefully is the work planned that scarcely any waste remains after the cutting. The linings are also cut in this room,—some from a light leather, and some from cloth. As the pieces come from the cutting tables, they are so grouped with the linings that each package represents the uppers for a case of shoes. These are ticketed, fastened together, and sent to the sewing room.

In the sewing room we find several long tables

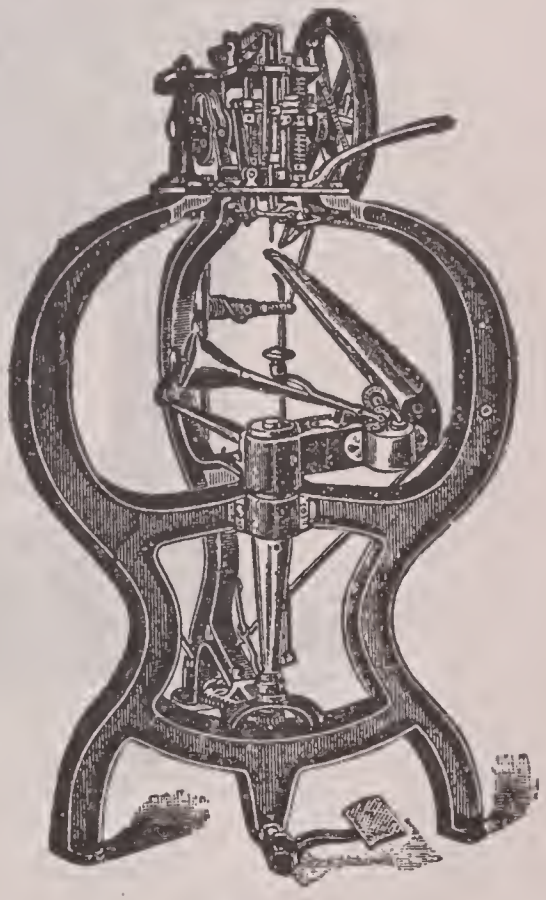
upon which are arranged sewing machines as near together as the operatives can sit and work to advantage. As a general thing, each line of machines is completed in itself, that is, it contains all the machines necessary to prepare the uppers for the sole. Each machine does but one thing; and the operative soon acquires a degree of skill which enables her to do that with a great degree of rapidity. One sews the vamp to the quarters, another sews the quarters together, another makes only buttonholes, another sews the binding, and so on, until the pieces have passed down the table and come out a finished upper ready for the sole.

The cutting of the bottoms is entirely different from that of the uppers. The stock is heavy and hard to work, consequently needs heavier machinery and stronger tools. The insoles are usually cut by hand—the workman using a die having the shape of the sole, and driving it through the leather with a heavy mallet. The outer soles are mostly cut by machines. The sides of leather are first cut into strips, the width of the strip being the length of the sole. These strips are rolled and run through the splitting machine, and then placed in a machine having a knife moved by a revolving table. The path of the knife is the outline of the sole, and it cuts the bottoms very rapidly. The heels are usually cut by hand by the use of dies, as in this way

nearly all of the small pieces can be used, and in order to prevent waste some dies cut only half lifts. These pieces are tacked together by boys who build the heels, and make them ready for the heeling machine. After cutting, the sole is soaked to make it pliable and then put into the press which shapes it for the shoe, giving it the bend at the instep and toe.

We now pass to the third department, where the sole and uppers meet, and the shoe is completed. Here we see the greatest skill displayed and find the most complicated machinery. The last, which is really a wooden foot to which the shoe was cut, is first placed in the upper to prevent crushing or deforming; on the bottom of the last the inner sole is laid. A workman places the whole in a clamp made for the purpose, and with his pincers proceeds to draw the upper down and nail it to the inner sole. This work is done by hand and requires considerable care, so as not to wrinkle the upper or draw it out of shape in the operation. Another workman fastens the outer sole with a couple of small nails to hold it in position. This is done by a machine. If the shoe is to be sewed, it now goes to the welt machine which cuts a groove for the stitches, and from there to the McKay sewing machine which sews the sole in place. This machine is a very interesting contrivance. It has two points resembling needles, and opera-

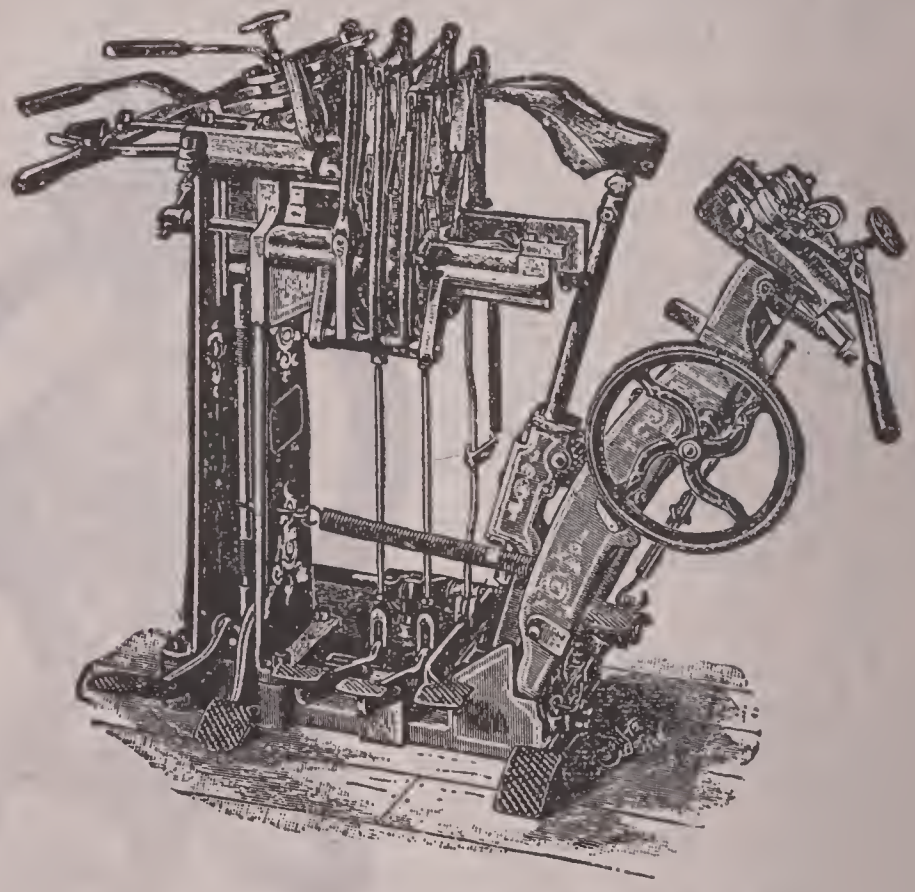
ting one on the inside of the shoe and the other on the out. They come together very much like the thumb and forefinger. One carries the thread, which passes through a pot of melted wax on its way, while the other has a hook very closely resembling that on an ordinary crochet needle. With this hook the loop is made which completes the stitch. After sewing, the welt is cemented and pressed back into place so perfectly that it does not show at all.



MCKAY SEWING MACHINE

Nailing and wire-sewing machines fasten the soles on to cheaper grades of shoes, and are equally ingenious. The nailing machine makes its nails from a little ribbon as it uses them, and will nail a sole to a shoe as quickly as it can be sewed. The wire cable machine uses a brass wire on which a thread is cut. This machine inserts the wire, turns it half way around, so as to get the effect of the thread, and cuts it off at the right length. Since the invention of this machine, pegged

shoes have almost wholly disappeared from the market, as the cable-sewed shoe has taken their place. The heel is now attached by the machine already described, and the shoe is ready for finishing.



COPELAND RAPID LASTER

The heel is turned and fashioned on a lathe, the edges of the sole are next trimmed and finished, and the shoe passes on to the blacking and polishing machines. These usually occupy a room by themselves known as the finishing room. Here all the delicate touches which have for their purpose giving the shoe a stylish

appearance, are put on. This room exists for the benefit of the market, as the operations do not add in the least to the benefit of the shoe. Here the soles are sand-papered, and polished so as to give them that peculiar white appearance so often seen. Most dealers have their firm name stamped upon the shoes, and this is also done in this room.

After leaving the finishing room laces need to be inserted, or buttons sewed on, as the case may be. The shoes are then packed for shipment. If of high grade they are usually wrapped in tissue paper, and each pair is placed in a separate box. Cheap shoes are packed in the large cases without separate boxing.

The marvelous rapidity with which the work is now done is in marked contrast to that of the old-fashioned shop, where a pair of shoes was considered a good day's work for one man. A few years ago a distinguished gentleman from England visited one of the factories in Lynn, and expressed his desire to learn the time necessary to make a pair of shoes. The manager selected a woman's shoe of good standard grade as a fair test, and hurried his guest from point to point in his attempt to follow the process as the pieces left the cutter's table, until at the end of twenty minutes the finished pair of shoes was placed in his hands. While this may be considered a fair test of rapidity, yet the unusual method used in

order to pass the shoes through the factory undoubtedly took somewhat longer than would be required in the regular work; in other words, the factory working in its regular way could produce shoes faster than at the rate of a pair in twenty minutes.

For a long time Massachusetts was the center of the shoe industry in the United States, and many of her large towns owe their development and prosperity to the shoe factories. Within the last few years, however, large factories have sprung up in New York, Philadelphia, Chicago, and other large cities, and smaller factories are now scattered very generally over the country. This industry consumes more leather than all others combined. We are now making more boots and shoes than we can use, and they are beginning to find a ready market in other countries. During the past five years our export trade in boots and shoes and leather has amounted to several million dollars annually, and it is constantly growing. The total value of the boots and shoes manufactured in the United States yearly is over $500,000,000 and the industry is constantly expanding.

RUBBER

Rubber is a substance composed principally of carbon and hydrogen, and obtained from the milky juice, or latex, of various families of plants, mainly found in tropical countries. Most, as well as the best, of the commercial crude rubber is produced in South America and known as Para rubber. In the basin of the Amazon and Orinoco occur a number of trees of the genus Hevea, belonging to the Spurge Family, which yield rubber. The Para rubber is principally obtained from a tree commonly known as the rubber tree. This is the tree which has been introduced into other parts of the world, notably Ceylon and British Malayasia, for the production of rubber. The Para rubber tree attains a height of over 60 feet, about six times its girth. The leaves are characteristically three-lobed, and the flowers are individually small and inconspicuous, but are borne in little sprays and are succeeded by dry fruits, each containing three seeds resembling the castor-oil bean in color. Large quantities of rubber are also obtained from the Valley of the Congo River in the central part of Africa.

COLLECTING THE RUBBER

The trees are tapped by cutting grooves in the trunk in such a position that the sap will flow into earthen cups placed at the lower end

of the groove. A good tree yields about 20 gallons of sap in a season, and this will make 50 pounds of crude rubber. The sap is evaporated by placing it in the sun or holding it over a fire. The latter method produces the better quality of rubber. The usual plan is to have a hollow cone of clay with a hole in its apex, which is placed over a fire made of the dried twigs and leaves of tropical plants. Into this hot smoke a paddle or stick, which has been dipped into the sap, is held. As fast as the amount collected is dried, more is added on the paddle, until 4 or 5 pounds have been collected. This mass is then removed from the paddle by cutting it through on one side. Several of these masses of crude rubber are packed in sacks holding about 100 pounds each.

GUAYULE RUBBER

Rubber from the guayule plant has recently been introduced and now supplies about one-seventh of the world's production. It is obtained from a plant closely related to the sunflower, whereas the other rubbers are chiefly obtained from trees or large woody climbers. The guayule is a small herbaceous plant growing in heights from a few inches to three and four feet, and is found principally in Mexico and in Texas, where it is being extensively cultivated. The milky juice is extracted from the plant

either by solvents or mechanical methods, the whole plant being removed and treated at the factories. The product contains a high percentage of resins, and is somewhat soft and sticky, but after treatment it is used to mix with Para rubber in the manufacture of the coarser articles, such as belting, motor tires, etc.

CORN RUBBER

A good quality of rubber is made from corn oil by vulcanizing the oil. Corn rubber is of a coarse texture, but it readily mixes with rubber from the rubber tree. It is not so elastic as India rubber but is especially well suited to making buffers, soles and solid tires.

MANUFACTURE

When the crude rubber is received at the factory, it is usually full of sand, dirt, pieces of bark, bits of leaves, stone and other foreign substances, and these must all be removed. This is accomplished by first putting the rubber into a tank of boiling water, then slicing it into pieces with knives, and afterwards putting it through a washing machine consisting of a pair of toothed rollers. Over these a number of streams of hot water are kept running to carry off the impurities as the rollers cut and squeeze them out, delivering the rubber in irregular strips.

The rubber now goes to a set of mixing rollers

in the hopper, where sulphur and other mixtures are introduced, and at this stage finely-ground portions of reclaimed rubber from old overshoes, hose, tires and other articles are all incorporated. The mass is now either carried to a set of steam-heated rollers to be rolled into sheets for coating cotton duck for making hose, tires, belting, etc., or to a kneading machine preparatory to being pressed into molds of various forms. The rubber is never melted but usually formed into a plastic state, in which condition it is easy to force it into the molds or into the fiber of cotton duck. This latter is accomplished by steam-heated rollers, one of which revolves more rapidly than the other, producing a friction or rubbing which presses the rubber thoroughly into the interstices and fibers of the fabric.

Vulcanized spread sheets are produced by spreading layers of India-rubber solution, previously charged with sulphur, on a textile base already prepared with a mixture of paste, glue and treacle. Vulcanization is effected by steam heat, and the preparation on the cloth being softened by water, the sheet is easily removed. Porous or spongy rubber is made by incorporating some material which gives off a gas or vapor at the vulcanizing temperature, such as carbonate of ammonia, crystallized alum and finely-ground, damp sawdust. Uncombined sul-

phur in the rubber is injurious to it and often leads to the rotting of vulcanized goods, but an excess of sulphur is generally required in order to secure perfect vulcanization. High temperature and a large proportion of sulphur produce an extremely hard rubber known as ebonite or vulcanite. This takes a high polish, and is useful to the electrician on account of its insulating properties, and to the chemist because vessels of it are unaffected by most chemicals. A special kind of vulcanite containing red pigments is used under the name of dental rubber for making plates for supporting artificial teeth. This form of rubber, slightly modified, is used to insulate the telegraphic cables.

HISTORY

India rubber was first shown in 1770 by Priestley, the scientist, and employed to erase pencil marks. Its general use began in 1825, when Mackintosh of England took out a patent for incorporating a benzine solution of it into the fabrics which bear his name, for waterproofing them. Goodyear in about 1845 discovered that crude rubber could be hardened or vulcanized by adding sulphur to it and heating. India rubber is elastic, a poor conductor of heat and a nonconductor of electricity. It is soluble in neither hot nor cold water, but dissolves readily in chloroform, naphtha, oil of

turpentine and bisulphate of carbon. Besides the crude rubber supplied from South American and African rubber trees, there are small quantities produced in Central America, Mexico, Cartagena, Java, Penang, Singapore, Assam and Natal, from different trees and plants, each bearing the name of its source.

The great demand for rubber has led many chemists to attempt its production by artificial methods, and, while they have succeeded in a measure, yet the cost compared to that of natural rubber is so great as to make commercial success prohibitive. The world's production of rubber is estimated at about 100,000 tons per annum, about 60 per cent of which goes to the United States, where about half of it is used in automobile tires. —*From "Home and School Reference Work" edited by W. F. Rocheleau, and published by H. M. Dixon, Chicago*

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